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A SUMMARY AND INTEGRATION OF RESEARCH CONCERNING SINGLE PILOT IFR OPERATIONAL PROBLEMS

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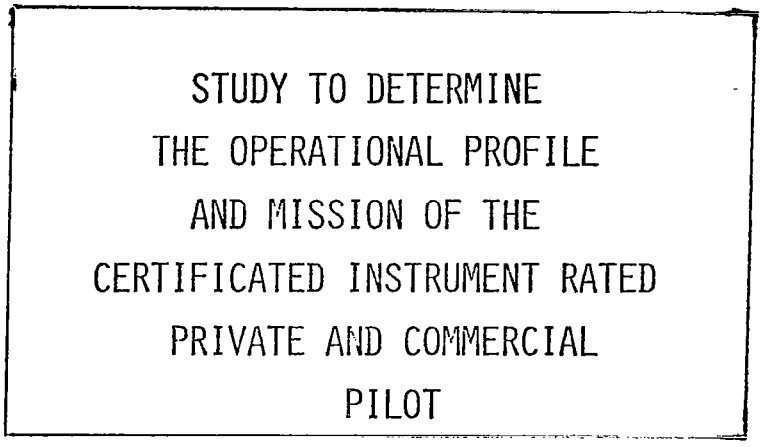
A review of seven research studies pertaining to Single Pilot IFR (SPIFR) operations was performed. Two studies were based on questionnaire surveys [1,2], two were based on National Transportation Safety Board (NTSB) reports [3,4], two were based on Aviation Safety Reporting System (ASRS) incident reports [5,6], and one report used event analysis and statistics to forecast problems [7]. The results obtained in each study were extracted and integrated. Results were synthesized and key issues pertaining to SPIFR operations problems were identified. The research that was recommended by the studies and that addressed the key issues is cataloged for each key issue.

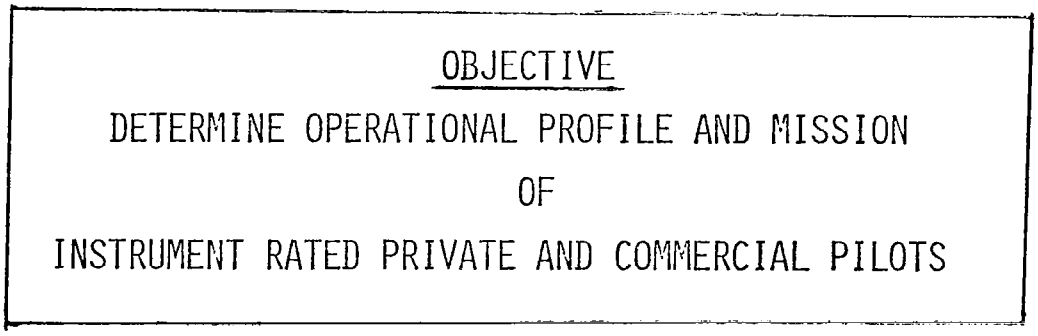
A SUMMARY AND INTEGRATION
OF RESEARCH CONCERNING
SINGLE PILOT IFR
OPERATIONAL PROBLEMS

TITLE:

Study to Determine the Operational Profile and Mission of the Certificated Instrument Rated Private and Commercial Pilot, Report No. FAA-RD-70-51. July 1970 [1].



Objective: Determine Operational Profile and Mission of Instrument Rated Private and Commercial Pilots. It was the first phase of an FAA effort which had as its objective the feasibility of training pilots to a standard of operational competence instead of using flight time as a criterion for instrument rating certification.



Methodology: Conduct a Mail Questionnaire Survey of Instrument Pilots. Approximately 3,000 of the then 120,000 instrument rated pilots were surveyed.

METHODOLOGY
CONDUCT A MAIL QUESTIONNAIRE SURVEY
OF
INSTRUMENT PILOTS

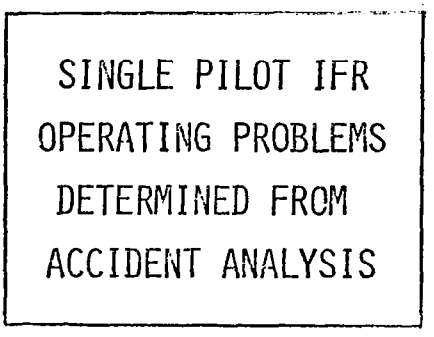
Results: Two Operational Profiles Were Developed: Most Complex, Medium Complex. The results of this study led to minor changes in the mid 1970's in the certification requirements for instrument rated pilots.

RESULTS:
TWO OPERATIONAL PROFILES WERE DEVELOPED:

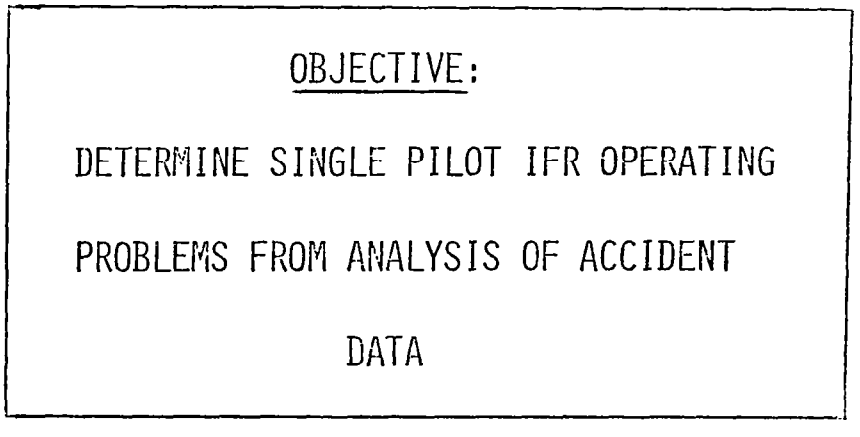
- MOST COMPLEX
- MEDIUM COMPLEX

TITLE:

Single Pilot IFR Operating Problems Determined From Accident Data Analysis, NASA TM-78773, September 1978 [3].



Objective: Determine Single Pilot IFR Operating Problems from Analysis of Accident Data.



METHODOLOGY:

Examine NTSB Aviation Accident Data for 1964-1975.

The accident reports examined were restricted to instrument rated pilots flying in actual IFR weather. A brief examination was made of accidents which occurred during all phases of flight and which were due to all causes. A detailed examination was made of those accidents which involved a single pilot which occurred during the landing phase of flight and were due to pilot error.

METHODOLOGY:

EXAMINE NTSB AVIATION ACCIDENT

DATA FOR 1964 - 1975

Results: SPIFR pilot error landing accidents are increasing at three times the dual pilot error rate.

It was found that the SPIFR pilot error landing accidents examined increased three times faster than the dual pilot error accidents during the same time period.

Problem areas were found to be pilot workload, low visibility at night due to fog and low ceilings, icing on aircraft not de-ice equipped, imprecise navigation, failure to remain above minimum altitudes, mismanagement of fuel and low instrument time.

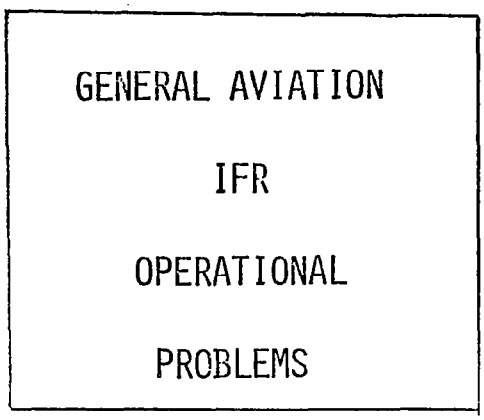
Some suggested areas of research include new types of de-icing or anti-icing equipment, standardized navigation instrument displays, improved fuel management systems and better methods for pilots to safely acquire experience and increase proficiency in SPIFR operations .

RESULTS:

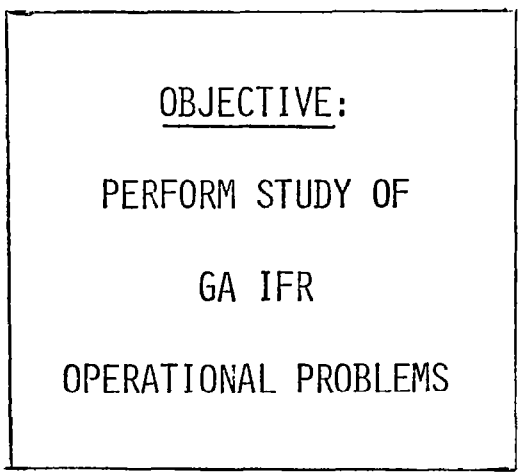
SPIFR PILOT ERROR LANDING ACCIDENTS ARE INCREASING AT THREE TIMES THE DUAL PILOT ERROR RATE

TITLE:

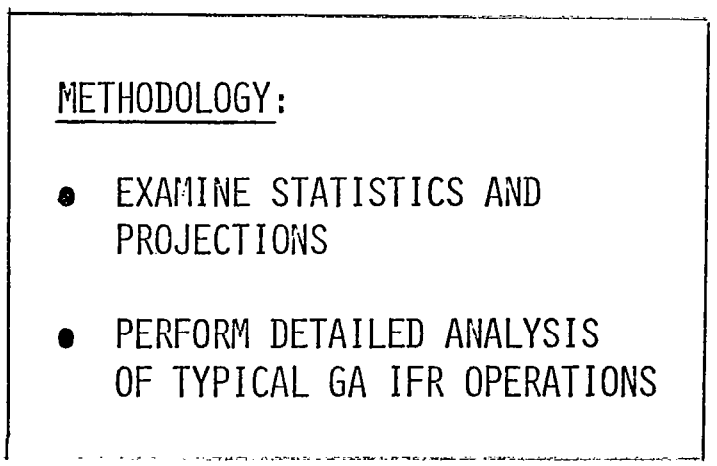
General Aviation IFR Operational Problems, NASA CR-159022, April 1979 [7].



Objective: Perform Study of GA IFR Operational Problems.



Methodology: Examine Statistics and Projections, Perform Detailed Analysis of Typical GA IFR Operations.



Results: GA SPIFR Major Segment of U. S. Air Transportation System. FAA provides ATC services with emphasis on improving efficiency with which the services are provided without concentrating on particular needs of various classes of operators. GA is being driven out of airspace through expansion of positive controlled airspace (e.g., floor, TCA). Result is to drive lower capability GA IFR operator away from services he needs. Cost to improve mission reliability too high (e.g., flight planning information availability, delays in terminal areas, delays in actual IMC limited landing and availability, enroute Wx avoidance).

RESULTS:

- GA SPIFR MAJOR SEGMENT
- FAA PROVIDES ATC SERVICES
- GA BEING DRIVEN OUT OF AIRSPACE
- COST TO IMPROVE MISSION RELIABILITY TOO HIGH

TITLE:

Analysis of General Aviation Single Pilot IFR Incident Data Obtained From the NASA Aviation Safety Reporting System, NASA TM-80206, October 1980 [5].

ANALYSIS OF GENERAL AVIATION

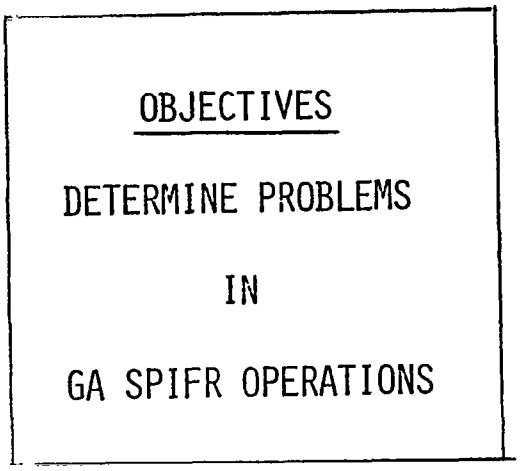
SINGLE PILOT IFR

INCIDENT DATA OBTAINED

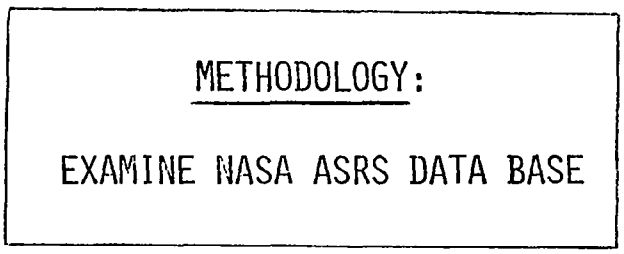
FROM THE

NASA ASRS

Objectives: Determine problems in GA SPIFR Operations.



Methodology: Examine NASA ASRS Data Base for Those Incidents Specifically Related to GA SPIFR Operations.



Results: Problem areas identified: controller judgment and response, pilot judgment and response, ATC intra/inter-facility conflicts, ATC/pilot communications, IFR-VFR conflicts

PROBLEM AREAS AND PRIMARY ELEMENTS

- Controller judgment and response problems
  - -Excessive/impeding procedural requirements
  - -Training proficiency/experience related mistakes
  - -Equipment operational problems
- Pilot judgment and response problems
  - -Excessive/impeding procedural requirements
  - -Training/proficiency flight infractions
  - -Limitations due to limited avionics
- ATC intrafacility and interfacility conflicts
  - -Internal communication problems
  - -Hand-off problems
  - -Mixed departure and arrival conflicts
  - -Equipment operational problems
- ATC and pilot communication problems
  - -Misunderstanding of instructions
  - -Frequency congestion
  - -Excessive frequency changes
  - -Excessive/impeding procedural requirements
- IFR-VFR conflicts
  - -Aircraft proximity at breakout
  - -IFR flight in VFR and MVFR conditions

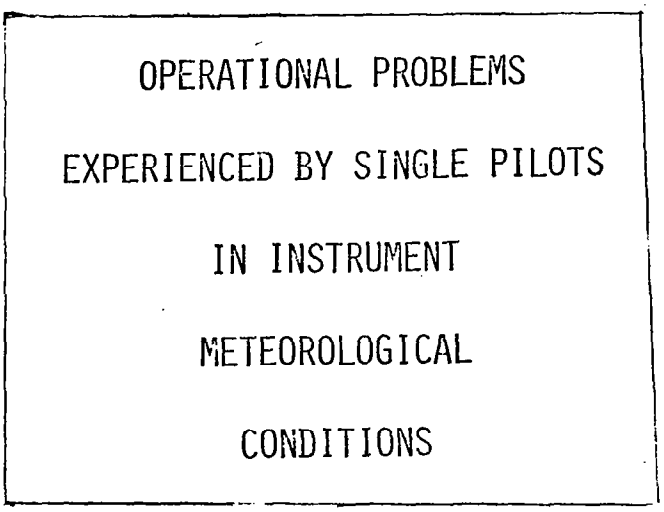
RESULTS:

PROBLEM AREAS IDENTIFIED

- CONTROLLER JUDGMENT AND RESPONSE
- PILOT JUDGMENT AND RESPONSE
- ATC INTRA/INTER FACILITY CONFLICTS
- ATC/PILOT COMMUNICATIONS
- IFR-VFR CONFLICTS

TITLE:

Operational Problems Experienced by Single Pilots in Instrument Meteorological Conditions, NASA CR-166236, July 1980 [6].



Objective: Identify and describe operational problems reported to NASA ASRS by the GA SPIFR.

OBJECTIVE:

IDENTIFY AND DESCRIBE OPERATIONAL PROBLEMS

REPORTED TO NASA ASRS BY THE GA SPIFR

Methodology: Examine NASA ASRS data base for occurrences where difficulties were experienced by single pilots on IFR flight plans in IMC.

METHODOLOGY:

EXAMINE NASA ASRS DATA BASE

Results: Ten conclusions developed about GA SPIFR operational problems.

Ten problem categories observed, in decreasing order of reporting frequency, were: (1) pilot allegations of inadequate service, (2) altitude deviations, (3) improperly flown approaches, (4) heading deviations, (5) position deviations, (6) below minimums operations, (7) loss of airplane control, (8) forgot mandatory report, (9) fuel problem, and (10) improper holding.

Examination of pilot experience data showed no correlation between inexperience and SPIFR problems, suggesting that experience may not be a primary factor. This led to a hypothesis that a solution to SPIFR problems may lie not in improving SPIFR capabilities through training but rather in changing the nature of the task. Safety, efficiency, and workload factors were present in the occurrences with over half involving an act or condition likely to lead to serious consequences and a third involving ignorant or imprudent departures from acceptable procedures. Human factors significant in many occurrences were: pilot "mind set", lack of pilot proficiency, lack of position awareness, distraction, and inadequate planning.

RESULTS:

TEN CONCLUSIONS DEVELOPED ABOUT

GA SPIFR OPERATIONAL PROBLEMS

TITLE:

Study to Determine the IFR Operational Profile and Problems of the General Aviation Single Pilot, NASA CR-3576, 1983 [2].

STUDY TO DETERMINE
THE IFR OPERATIONAL PROFILE
AND PROBLEMS
OF THE GENERAL AVIATION
SINGLE PILOT

Objective: Develop SPIFR operational profile, identify problems experienced, recommend research.

OBJECTIVE:

- DEVELOP SPIFR OPERATIONAL PROFILE
- IDENTIFY PROBLEMS EXPERIENCED
- RECOMMEND RESEARCH

Methodology: Conduct a mail questionnaire survey of 5000 of the 230,000 instrument rated pilots (47% response).

METHODOLOGY:

CONDUCT A MAIL QUESTIONNAIRE SURVEY OF INSTRUMENT PILOTS

Results: Areas requiring research: Workload, Pilot Judgment/ Decision making, Instrument Approaches, Weather Information, Cockpit Environment, Communications.

RESULTS:

AREAS REQUIRING RESEARCH

- WORKLOAD
- PILOT JUDGMENT/DECISION MAKING
- INSTRUMENT APPROACHES
- WEATHER INFORMATION
- COCKPIT ENVIRONMENT
- COMMUNICATIONS

TITLE:

Single Pilot IFR Accident Data Analysis, NASA CR-3650, June 1982 [4].

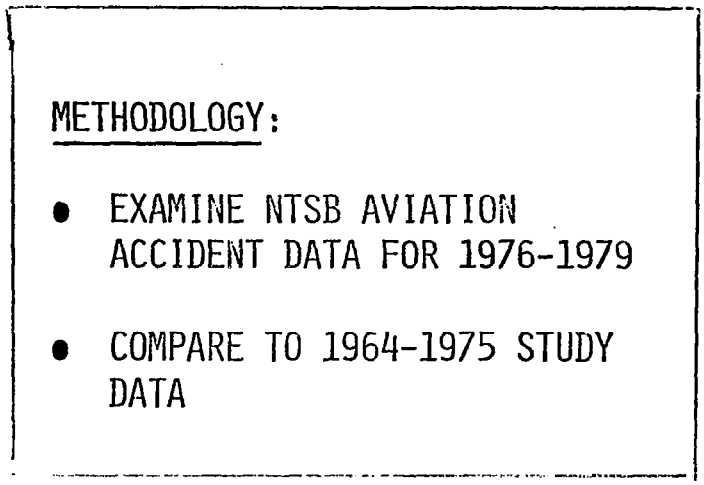
SINGLE PILOT IFR PROFICIENCY ANALYSIS

Objective: Determine what changes, if any, have occurred in trends and cause and effect relationships reported in 1978 study by Forsyth and Shaughnessy [3].

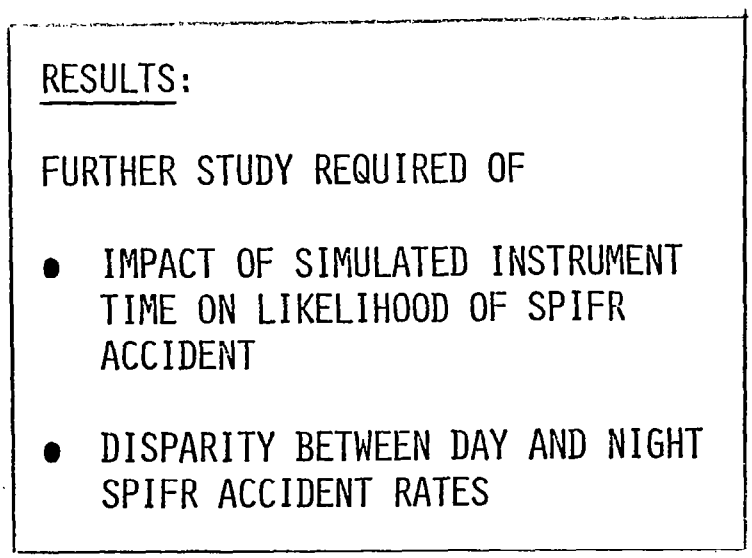
OBJECTIVE:

DETERMINE CHANGES FROM PREVIOUS STUDY

Methodology: Examine NTSB Aviation Accident Data for 1976-1979, Compare to 1964-1975 study data.



Results: General Conclusion: GA SPIFR accident frequency total, causes, and trends have undergone little overall change since the previous study. Further study required of impact of simulated instrument time on likelihood of SPIFR accident, disparity between day and night SPIFR accident rates.



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1. Study to Determine the Operational Profile and Mission of the Certificated Instrument Rated Private and Commercial Pilot. FAA-RD-70-51, Federal Aviation Administration, July 1970.

2. Weislogel, G. S.: Study to Determine the IFR Operational Profile and Problems of the General Aviation Single Pilot. NASA CR-3576, 1983.

3. Forsyth, Donna L.; and Shaughnessy, John D.: Single Pilot IFR Operating Problems Determined From Accident Data Analysis. NASA TM-78773, Sept. 1978.

4. Harris, D. F.; and Morrisette, J. A.: Single Pilot IFR Accident Data Analysis. NASA CR-3650, June 1982.

5. Bergeron, Hugh P.: Analysis of General Aviation Single Pilot IFR Incident Data Obtained From the NASA Aviation Safety Reporting System. NASA TM-80206, Oct. 1980.

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